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A Pictorial Field Key

to the

ARMYWORMS AND CUTWORMS

ATTACKING

CORN

IN THE NORTH CENTRAL STATES

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A PICTORIAL FIELD KEY TO THE ARMYWORMS AND CUTWORMS ATTACKING CORN IN THE NORTH CENTRAL STATES[1]

Roy W. Rings[2] and G. J. Musick[3]

Introduction

This publication contains two pictorial keys. The first key is for the identification of the different groups of soil pests, such as slugs, wireworms, white grubs, millipedes, and caterpillars (armyworms and cutworms). If you identify your specimen as an armyworm or cutworm, then proceed to the second key (on page 8) to identify the caterpillar to species.

The key is designed to use in the north central United States but is probably applicable to most of the eastern states and lower central Canada. The key will not work for very young larvae (1st to 3rd instars) which are less than 3/4 inch long in most cases. The key does not include some of the common cutworms in the southern and western United States. This key is neither infallible nor final. To make the key easier to use, many less common cutworms have been omitted. If you should try to determine the caterpillar of an omitted species, you will either be unable to identify it or end up in the wrong place.

Suggestions on how to scout for and preserve armyworms and cutworms are given on pages 4 and 34.

How to Use the Keys

To use the keys, begin at the first couplet and decide which of the alternatives best fits the specimen to be identified. The number at the far right in each couplet indicates at what point you should proceed with the key. Each couplet choice is illustrated by one or more black and white illustrations of soil pests or caterpillars. When you reach an illustration which is most nearly like the unknown specimen, you should have made a determination of the species. Individuals within a species may vary somewhat in marking and color depending upon food and various climatic factors, but usually retain certain basic species characters.

If there is any doubt about the identification, check the larval description on the page opposite the larval illustration for a more detailed and technical description. A stereomicroscope is necessary to confirm the technical descriptions.

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[1]Investigations supported in part by Environmental Protection Agency Grant No. EPA R802547 and U.S.D.A. Cooperative State Research Service Grant No. 316-15-99. A cooperative research program including University of Missouri, Illinois Natural History Survey, Iowa State University, Michigan State University, University of Nebraska, New York State Agricultural Experiment Station, Ohio Agricultural Research and Development Center, Purdue University, and the University of Wisconsin.

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A Pictorial Key to Groups of Soil Pests Attacking Corn

1. Pests without legs; 1/4 to 1 inch long; slime-covered; with two retractable "feelers" on head (Fig. 1) ..... Slugs

Figure 1.--A slug.

Pest with six or more legs 2

2. Pest with only six legs (Figs. 2 and 3) 3

Pest with more than six legs (including prolegs Figs. 4 and 5) 4

3. Pest with brownish head and whitish body; usually coiled in C-shape (Fig. 2) ..... White Grubs

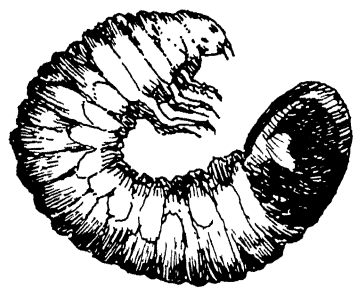

Figure 2.--A white grub.

Pest light or dark brown; hard-bodied; wire-like (Fig. 3) ..... Wireworms

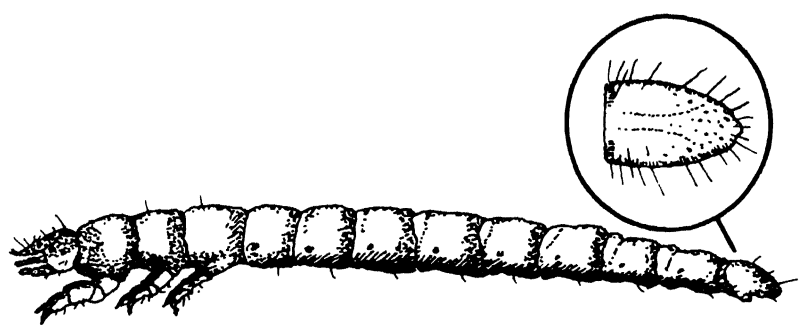

Figure 3.--A wireworm.

4. Pest with six pointed legs on front of body; ten blunt legs on middle and rear of body. Body not covered with large, darkly pigmented plates (Fig. 4) ..... Cutworms and Armyworms

Figure 4.--A cutworm.

Pest with six pointed legs on front of body; ten blunt legs on middle and rear of body. Body covered with large, darkly pigmented plates (Fig. 5) ..... Sod Webworm

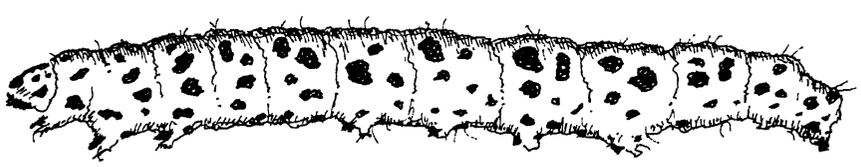

Figure 5.--A sod webworm.

Pest with more than ten pairs of legs; legs all same shape; body cylindrical (Fig. 6) ..... Millipedes

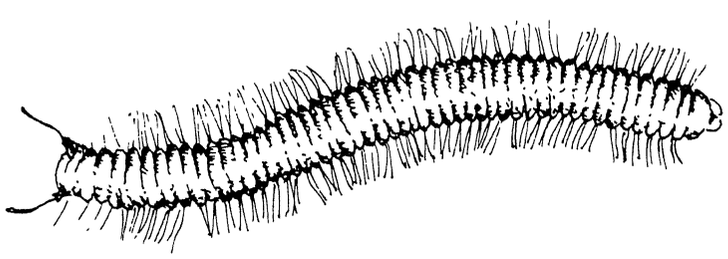

Figure 6.--A millipede.

How to Scout for Armyworms and Cutworms

Armyworms: The armyworm, yellow-striped armyworm, and fall armyworm feed on the leaves of corn and thus the damage is obvious if much feeding has occurred. Since the armyworm (*Pseudaletia unipuncta*) is the major armyworm problem in the north central states, the scouting procedures outlined here are particularly applicable to this species.

If the corn plants are less than 8 inches tall, armyworms will either consume all leaves or destroy the total plant including the stalk. If the growing point of the corn plant (usually young corn) is damaged, the plant dies. When armyworms attack taller corn, they consume the more tender portions of the leaves and leave the midrib.

During the day, armyworms will be found hiding under clods of earth, stones, and debris, or in cracks in the soil. Some larvae will almost always be found in the whorl of the plant where shade is provided.

Armyworm damage in conventionally tilled corn is usually most evident at the periphery or edges of the corn field where the larvae have migrated from some other crop, usually wheat or grasses. In no-tillage corn, they are found throughout the field and are commonly found where corn follows alfalfa-grass pasture, cereal crops (rye, etc.), or any grassy vegetation. Since this vegetation is killed with an herbicide, the larvae move to corn.

Initiate scouting immediately upon emergence of the corn plants. Fields with emerged corn should be examined two to three times per week from May 25 to June 25. To scout for armyworms in conventionally tilled corn, select five areas at random in the field to be examined. Usually areas are selected around the edges of the field. Examine the plants in 25 to 50 feet of row in each area. Examine the whorl and leaves for damage and look in the whorl for larvae. If leaf and/or whorl damage is observed, look in the whorl and under stones, clods, or debris near damaged plants for the larvae. Record the percent damaged plants and number of armyworms per plant or per foot of row. Consult recent insect control recommendations for treatment procedures and thresholds.

In no-tillage corn, following grass or cereal crops, select at least five areas (ten are better) at random over the entire field and examine the plants in 25-50 feet of row for larval damage. Examination, larval determinations, and treatment procedures are the same as outlined for conventionally tilled corn. For no-tillage, continuous corn with minimal weed growth in spring, the procedures are the same as outlined for conventionally tilled corn.

Cutworms: Some cutworm species will feed on the leaves of corn plants but most cut off the entire plant from 1 inch below soil level to as much as 1 to 2 inches above the soil surface. The black cutworm, the most important cutworm attacking corn, usually constructs a tunnel about 1 to 2 inches deep. During the night, the larva cuts a plant, drags it into this tunnel, and feeds upon it during the day.

Corn plants are most susceptible to black cutworm damage when they are less than 15 inches in height. However, taller plants are sometimes attacked. Damage to the taller plants is either superficial and confined to the outer portion of the stalk at the base of the plant, or is caused by the larva boring into the base of the plant, destroying the growing point and killing the plant. Generally, severe damage is observed on younger corn.

In scouting for cutworms, randomly select four to five areas in the field for examination. Initiate scouting procedures immediately on emergence of the corn plants. Fields with emerged corn should be examined two to three times per week from May 1 to June 15. Carefully, yet rapidly, examine the plants in 25-50 feet of row in each of these areas for cut-off or wilted corn plants. If either is found, use a trowel or similar tool and dig around the damaged plant for cutworms (*i.e.*, verify damage is caused by cutworm). Missing plants in a row do not necessarily indicate cutworm damage since this damage may be caused by a defective planter, depredating birds, or rodents.

After cutworm damage has been verified, continue with a more through examination in four to five additional areas. Carefully examine and record the number of damaged plants and number of cutworm larvae per plant or per foot of row. If damage is present at low levels, re-examine the field for at least 2 more consecutive days. If damage is readily evident or continues, consult Extension Service recommendations for control procedures.

Some More Important Characters Used in Identification of Armyworms and Cutworms

Longitudinal stripes: The most prominent and recognizable features of armyworms and some cutworms are variously colored longitudinal stripes. The locations and names of these longitudinal stripes are shown in Figure 7.

Other markings: In addition to the longitudinal stripes, other prominent markings include the wedge-shaped markings on the spotted cutworm (Fig. 27), the row of pale spots down the center of the back of the variegated cutworm (Fig. 23), and the intricate markings on the back of the dingy cutworm (Fig. 31).

Head markings: The presence or absence of markings on the head help to separate and identify different cutworms. Two of the most important head markings are the submedial arcs and the extent of the reticulation (Fig. 8).

Tubercles: The hair-bearing (or setigerous) tubercles are small, wart-like bumps on the body which bear inconspicuous hairs or setae. These vary in size and intensity of pigmentation and are characteristic of each species (Fig. 41).

Cervical shield: This is an oval, sclerotized plate just behind the head on the top of the thorax. It sometimes has prominent markings as in Fig. 11.

Anal shield: This is a triangular, sclerotized plate at the tip of the rear end of the body on top. It also sometimes has prominent markings (Fig. 11).

Skin texture: There are numerous variations of skin texture ranging from completely smooth to a rough, lumpy texture (Fig. 41). A magnification of about 500X is required to observe the various skin textures.

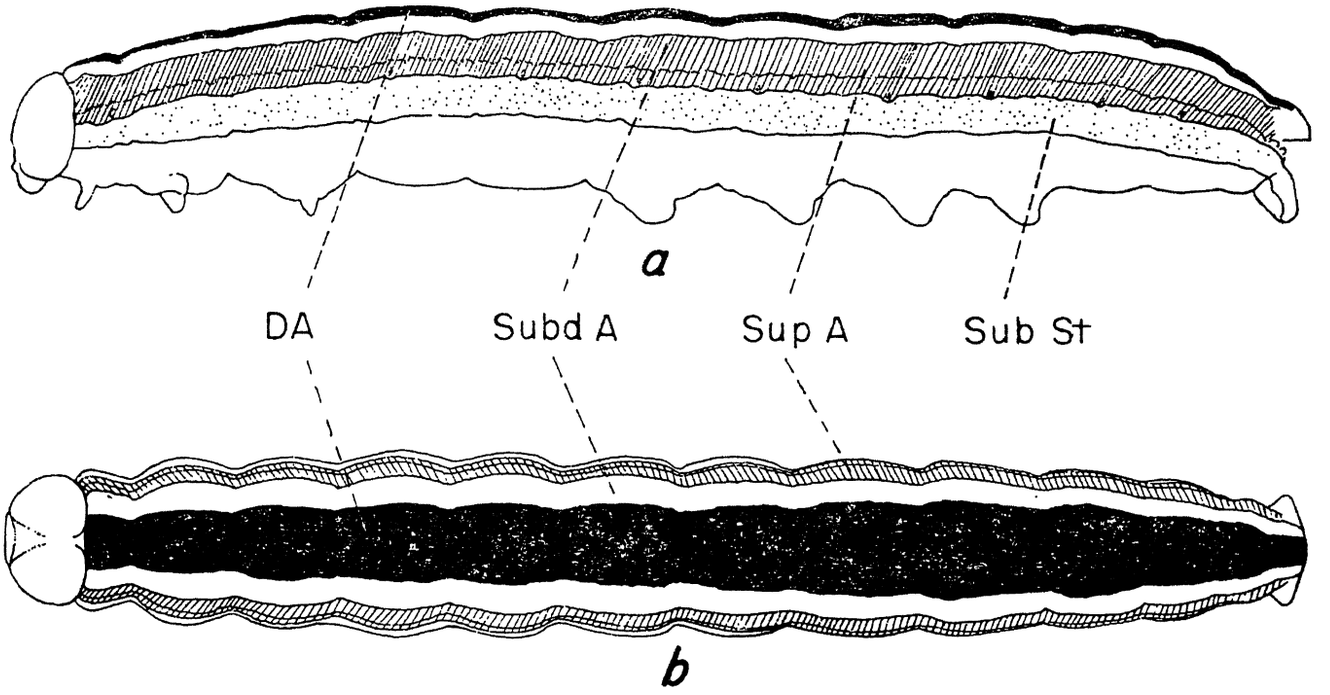

Figure 7.--Normally occurring stripes on cutworms and armyworms. a. Side view. b. Top view. Abbreviations: DA = dorsal; Subd A = subdorsal area; Sup A = supraspiracular area; Sub St = subspiracular area.

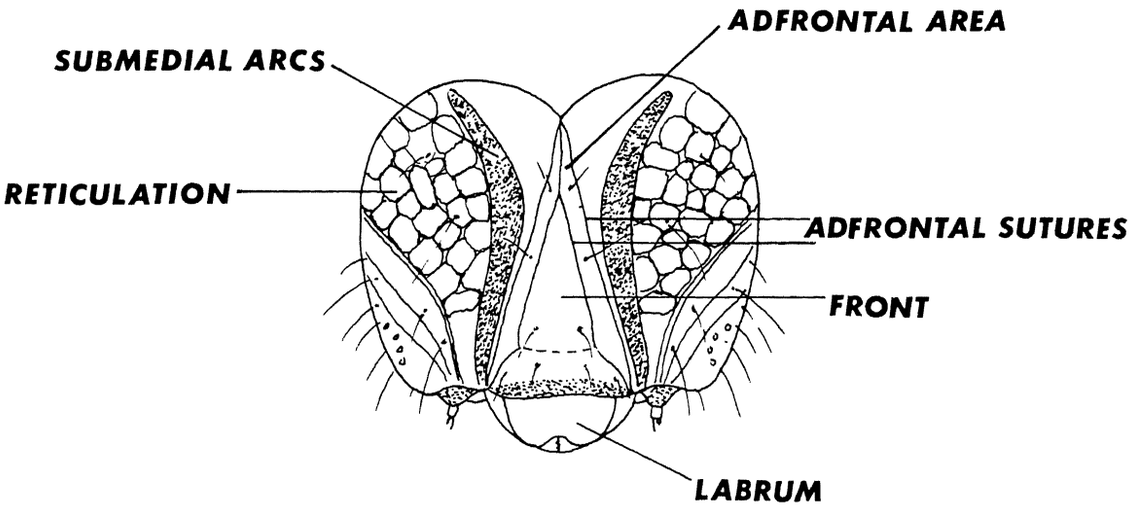

Figure 8.--Front view of head showing key structures and markings.

A Pictorial Key for Identifying Armyworms and Cutworms Attacking Corn in the North Central States

1. Caterpillar with conspicuous markings (Figs. 10 to 27) 2

   Caterpillar without conspicuous markings or with faint or inconspicuous markings (Figs. 30 to 46) 7

2. Caterpillar with longitudinal stripes over most of body (Figs. 10 to 20) ... 3

   Caterpillar with prominent spots or wedge-shaped markings on back (Figs. 23 and 27) 6

3. Caterpillar with only three longitudinal stripes; very distinct on neck and tail; body dark brown with a bronzy sheen (Fig. 11) ..... Bronzed Cutworm

   Caterpillar with more than three longitudinal stripes (Figs. 13 to 17) 4

4. Caterpillar with a double row of black, triangular markings on back bordered with a narrow white stripe; several indistinct stripes on sides (Figs. 13 and 14) ..... Yellow-striped Armyworm

   Caterpillar without a double row of black triangular spots 5

5. Caterpillar with two broad orange stripes on sides of body and two dark stripes on back (Figs. 16 and 17) ..... Armyworm

   Caterpillar yellowish-gray with a series of diamond-shaped markings on back; hairs on body coarse and prominent; small (3/4 inch) (Fig. 20) ..... Bristly Cutworm

6. Caterpillar dark, mottled gray; a row of four to seven small, pale yellow markings down center of back; a conspicuous light stripe on side (Fig. 23) ..... Variegated Cutworm

   Caterpillar light gray; a pair of wedge-shaped markings on back of each abdominal segment becoming larger toward the rear of the body (Fig. 27) ..... Spotted Cutworm

7. Caterpillar with inconspicuous markings (Figs. 30 to 40) 8

   Caterpillar with no markings; all whitish or grayish (Figs. 43 and 46) ... 11

8. Caterpillar with several indistinct dark stripes on back (Figs. 31 and 33) 9

   Caterpillar with only one broad or narrow inconspicuous stripe on back (Figs. 35 and 40) 10

9. Caterpillar brownish-tan; a faint, dark, V-shaped marking on back of each abdominal segment (Fig. 31) ..... Dingy Cutworm

   Caterpillar dull gray with numerous stripes; the dark gray stripe just above the spiracles prominent; setal tubercles heavily pigmented (Fig. 32) ..... Dark-sided Cutworm

10. Caterpillar with a broad, lighter stripe down middle of back; four dark-pigmented tubercles inside broad stripe on each segment; occurs late in year (August and September) (Fig. 36) ..... Fall Armyworm

    Caterpillar with a narrow, lighter stripe down middle of back; body color gray to black; skin granulose (Figs. 40 and 41) .... Black Cutworm

11. Caterpillar head and neck shield reddish-brown; body all white (Fig. 44) ..... Glassy Cutworm

    Caterpillar head and neck same color as body (Fig. 46) ..... Sandhill Cutworm

BRONZED CUTWORM

Nephelodes minians Guenee

General color dark brown to blackish above and paler below, usually with a distinct bronzy sheen. Body from 35 to 45 mm. long and 9 mm. wide at middle. A broad, sharply defined, mid-dorsal yellow stripe. A broad, pale, subspiracular stripe. Spiracles black. Head dark brown to brownish-gray, usually with faint, darker reticulation. Mandible without teeth. Cervical and anal shields black, each with three distinct pale stripes. Skin set closely with small, dark, isolated, round, shining granules (Fig. 9).

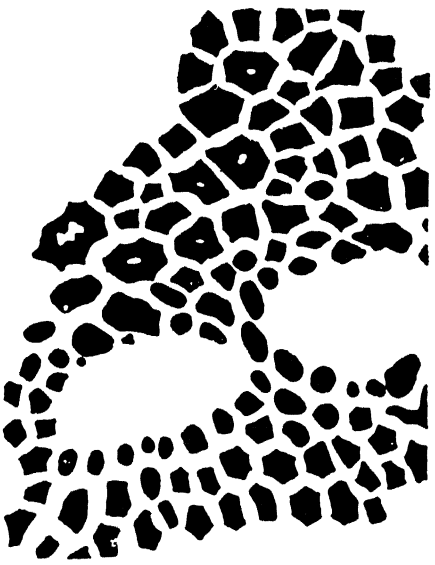

Figure 9.--Skin texture of bronzed cutworm (magnified 5,000X).

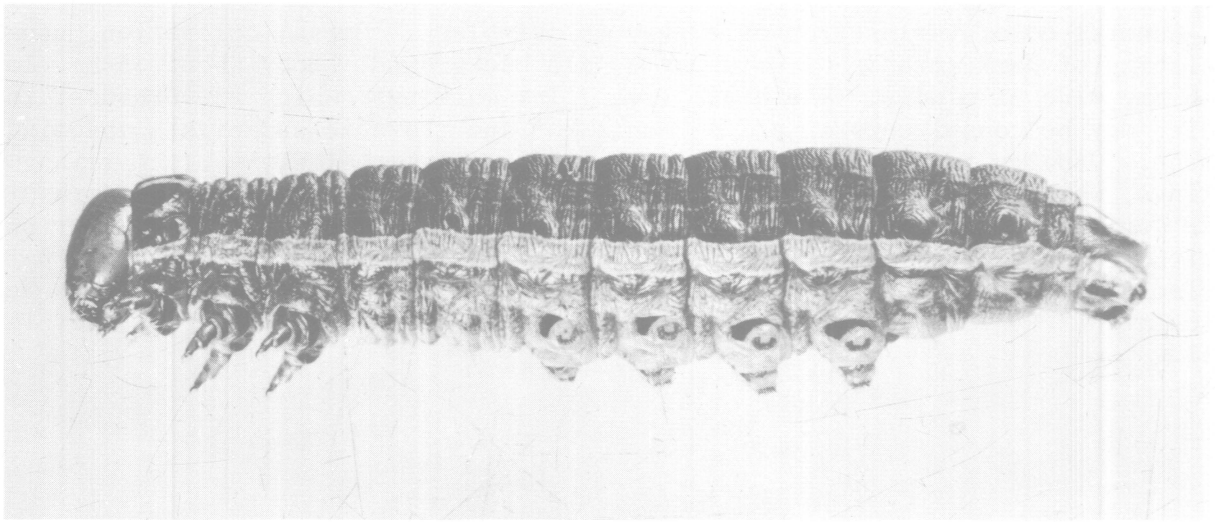

Figure 10.--Lateral view of bronzed cutworm (3.6X).

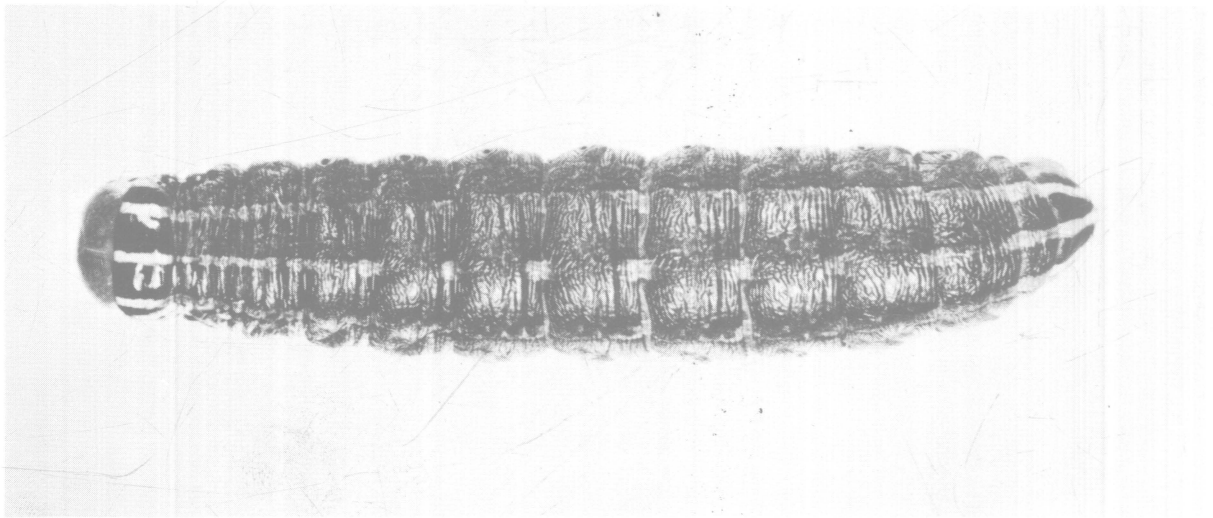

Figure 11.--Dorsal view of bronzed cutworm (3.6X).

YELLOW-STRIPED ARMYWORM

Spodoptera ornithogalli (Guenée)

General color varies from pale gray to jet black. Dorsal coloration, usually consisting of dark strands of color on a pale background. Body about 35 mm. long and 6 mm. wide at middle. The black triangular markings, which are broadest in the middle, may be conspicuous on all segments but the thoracic and eighth abdominal segment. Usually there is a bright yellow stripe, just below the black triangular markings, which contains four narrower lines. There is usually a dark supraspiracular stripe which includes the spiracles at its lower edge. This broad stripe is longitudinally marked with irregular pale lines. A broad subspiracular stripe may be flecked with orange or pink. Head brown; overlaid with heavy, dark, obscure reticulation (Fig. 12). Skin smooth. Spiracles brownish. Setigerous tubercles small.

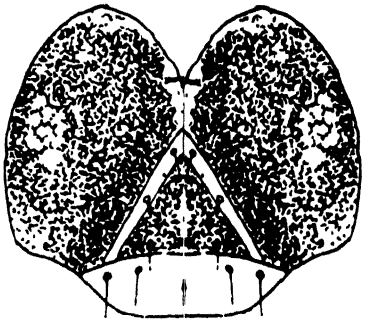

Figure 12.--Front view of head characters of yellow-striped armyworm (13X).

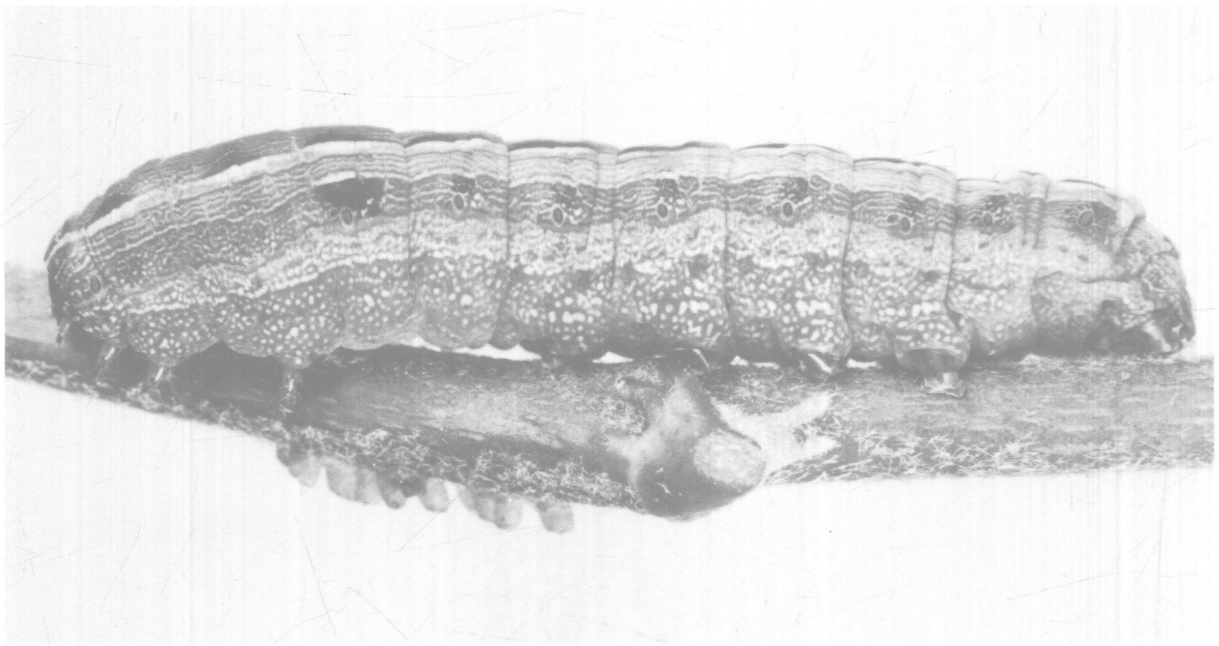

Figure 13.--Lateral view of yellow-striped armyworm (3.8X).

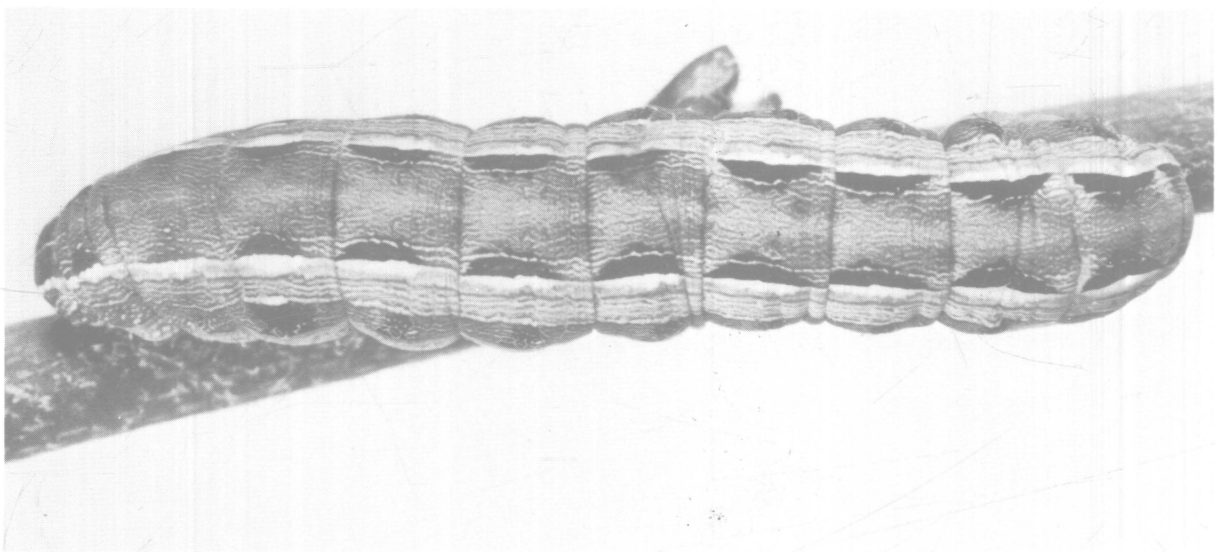

Figure 14.--Dorsal view of yellow-striped armyworm (3.8X).

ARMYWORM

Pseudaletia unipuncta (Haworth)

Ground color yellowish or gray, more or less tinged with pink. Body about 35 mm. long and 5 mm. wide at middle, tapering posteriorly. Back of caterpillar greenish-brown to black with a narrow, broken, light stripe down the center. On each side of this stripe is a broad band of mottled brown, darker at the edges. Below this band a narrow white stripe is followed by an orange or brown stripe edged with white. Below this is a dark stripe which includes the spiracles in its lower edge. Below the spiracles is a pale orange stripe mottled and edged with white. Underside gray or cream with brownish mottling. Head pale gray or greenish-brown with numerous dark reticulations and dark streaks near the adfrontal sutures (Fig. 15). Mandible without distinct teeth on the cutting margin. Cervical shield brown with three narrow, pale stripes. Skin smooth. Spiracles entirely black.

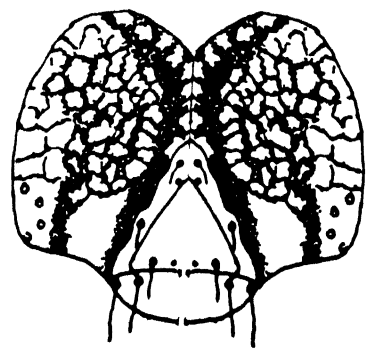

Figure 15.--Front view of reticulations on head of the armyworm (13X).

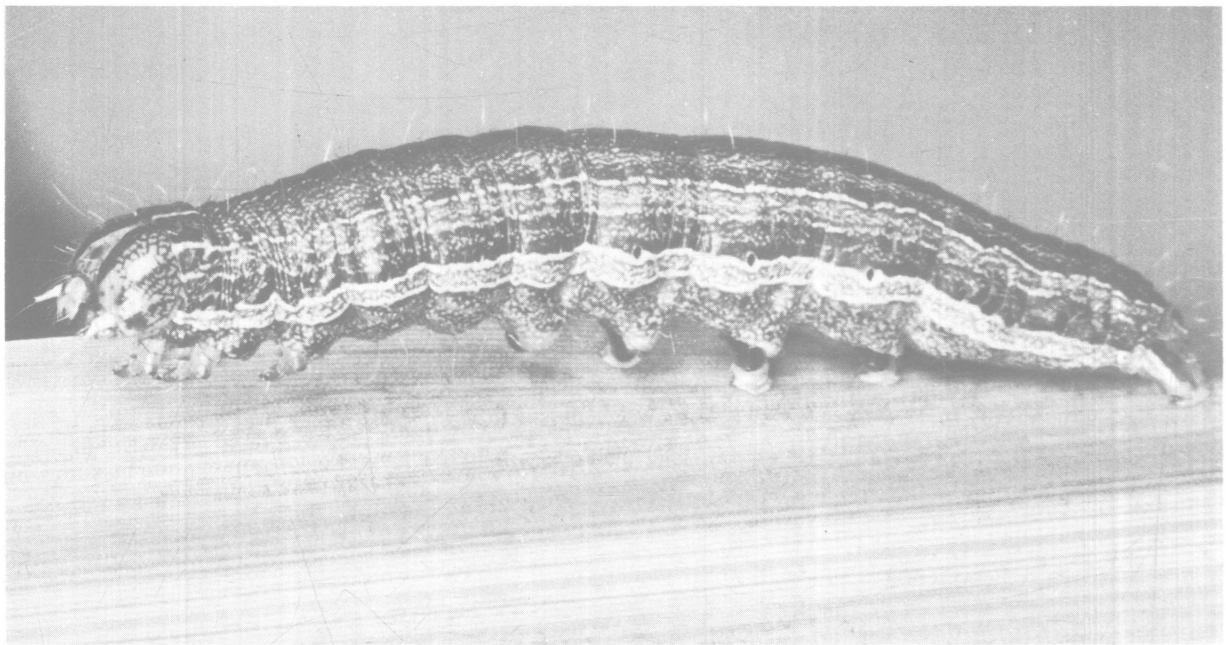

Figure 16.--Lateral view of armyworm (3.5X).

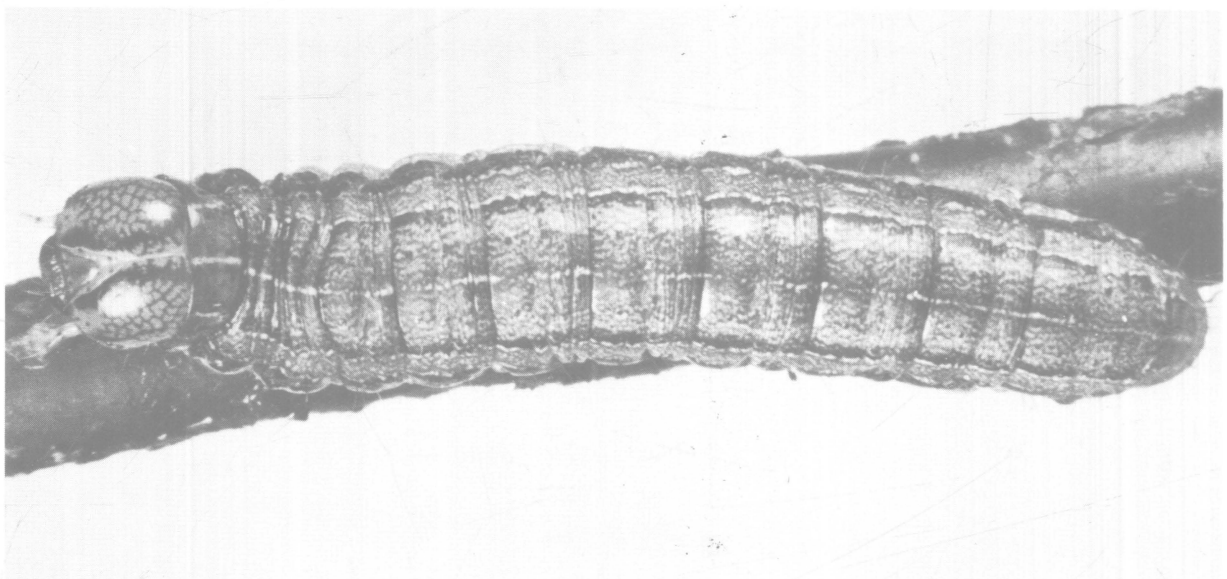

Figure 17.--Dorsal view of armyworm (3.5X).

BRISTLY CUTWORM

Lacinipolia renigera (Stephens)

General color pale gray. Body only about 25 mm. long and 4.5 mm. wide at middle, tapering slightly posteriorly. Dorsal area pale, with a broad, median, dark stripe constricted at the juncture of segments to form a series of diamond-shaped or egg-shaped marks. An inconspicuous, subdorsal, narrow, pale stripe more or less flecked with brown. Upper half of supraspiracular area includes a prominent, continuous black stripe; lower half blackish, much flecked with white. Setae heavy and unbranched. Head grayish-brown; coarsely granulose; the black submedial arcs and reticulation almost obscure the ground color dorsally. Skin bearing coarse, isolated, elevated granules (Fig. 18). Spiracles dark brown.

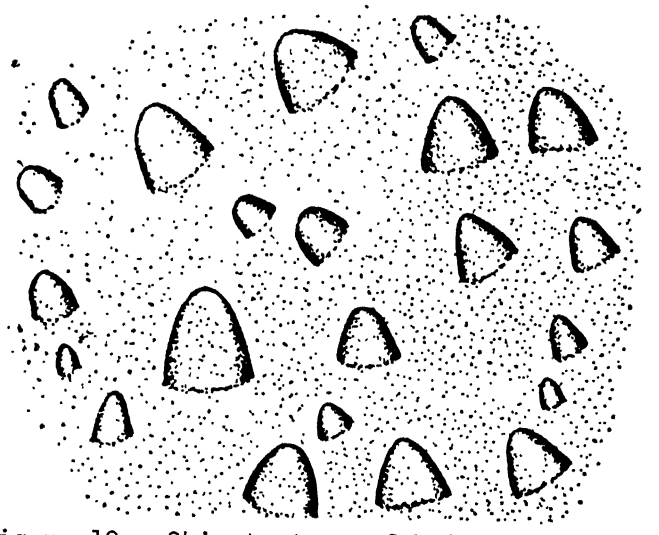

Figure 18.--Skin texture of bristly cutworm (5,000X).

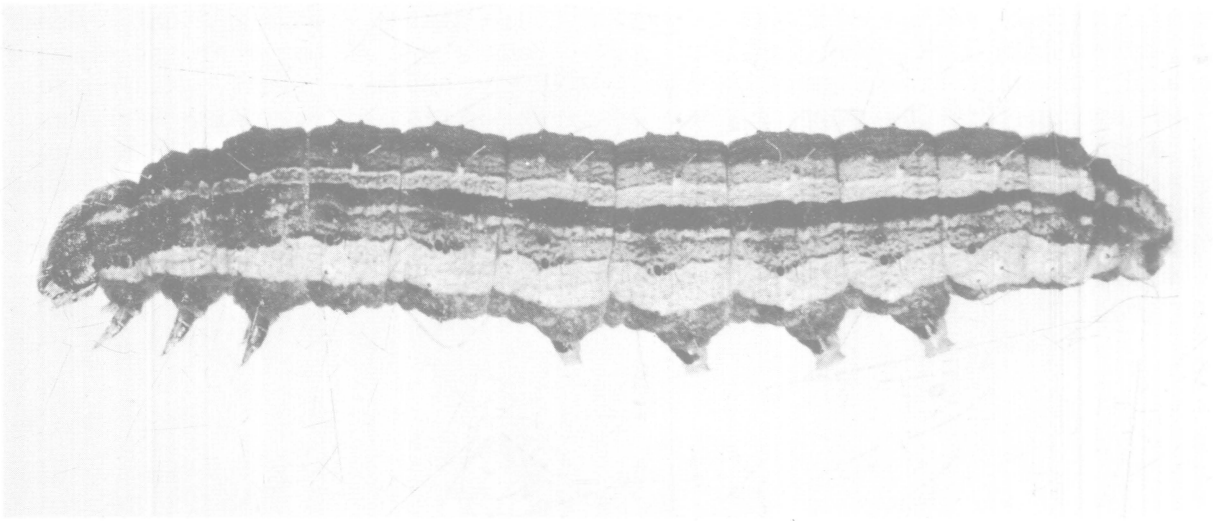

Figure 19.--Lateral view of bristly cutworm (6X).

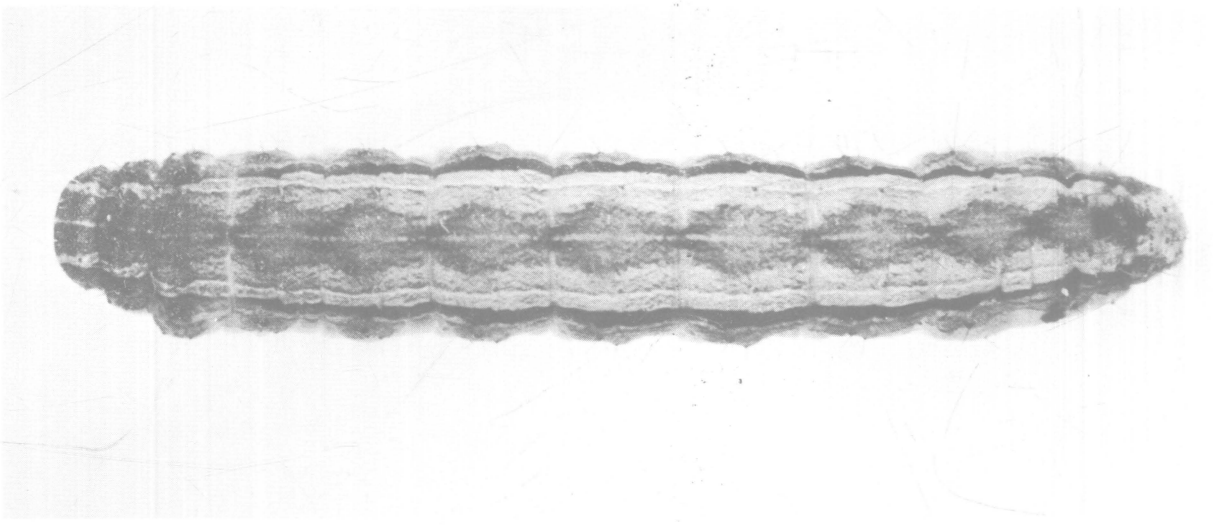

Figure 20.--Dorsal view of bristly cutworm (6X).

VARIEGATED CUTWORM

Peridroma saucia (Hübner)

There is a wide variation in color and intensity of color between individuals; however, the pale yellow markings on the back are almost always present. General color varies from dark brown to light gray. Body about 40 mm. long and 6 mm. wide at middle; the posterior segment somewhat enlarged and very blunt. Mid-dorsal "stripe" broken, leaving four to seven distinct whitish or yellowish markings; sometimes absent in earlier instars. In the final instar there is usually a black W-shaped mark on the dorsum of the eighth abdominal segment, followed by a conspicuous yellow or orange area. Usually a narrow, orange-brown spiracular stripe. Subspiracular area and ventral area paler with irregular orange and yellow markings. Head whitish with broad, black submedial arcs and a varying amount of darker reticulation (Fig. 21). Skin smooth. Spiracles black.

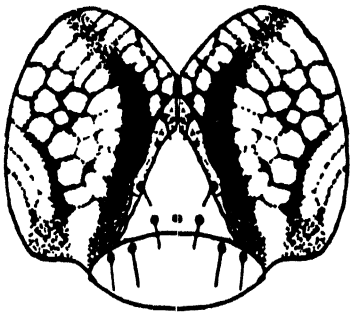

Figure 21.--Front view of head of variegated cutworm showing submedial arcs (13X).

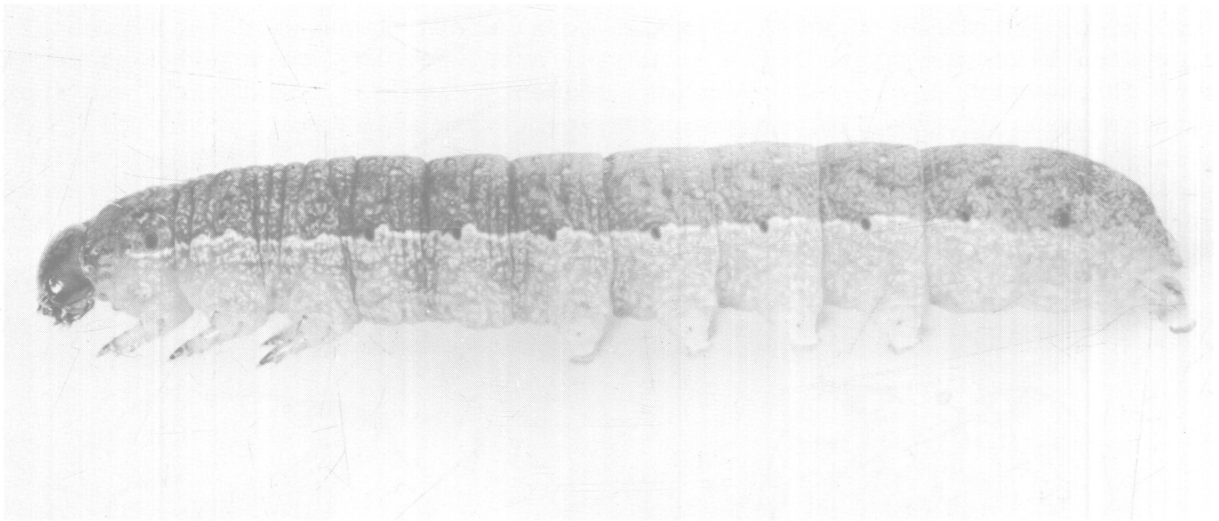

Figure 22.--Lateral view of variegated cutworm (3X).

Figure 23.--Dorsal view of variegated cutworm (3X).

SPOTTED CUTWORM

Amathes c-nigrum (L.)

General color varies from brown to grayish. Body about 35 mm. long and 4.5 to 6.5 mm. wide; abdominal segments of about equal width throughout. A segmental series of elongated black markings in the subdorsal area, forming large wedge-shaped markings on the seventh and eighth abdominal segments. Dorsal, subdorsal, and supraspiracular areas of the same color, sometimes tinged with brown or orange. A broad, pale subspiracular stripe tinged with pinkish or orange. Head pale brown with black submedial arcs and dark brown reticulation (Fig. 24). Mandible with four prominent outer teeth and one inner tooth (Fig. 25). Skin smooth. Spiracles whitish or yellowish.

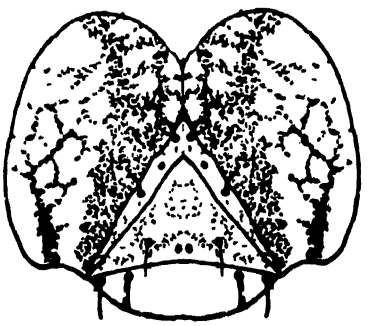

Fig. 24.--Front view of head of spotted cutworm (13X).

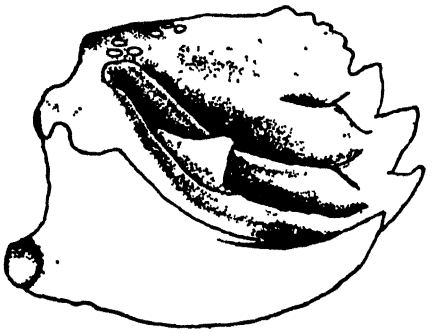

Figure 25.--Left mandible of spotted cutworm (62X).

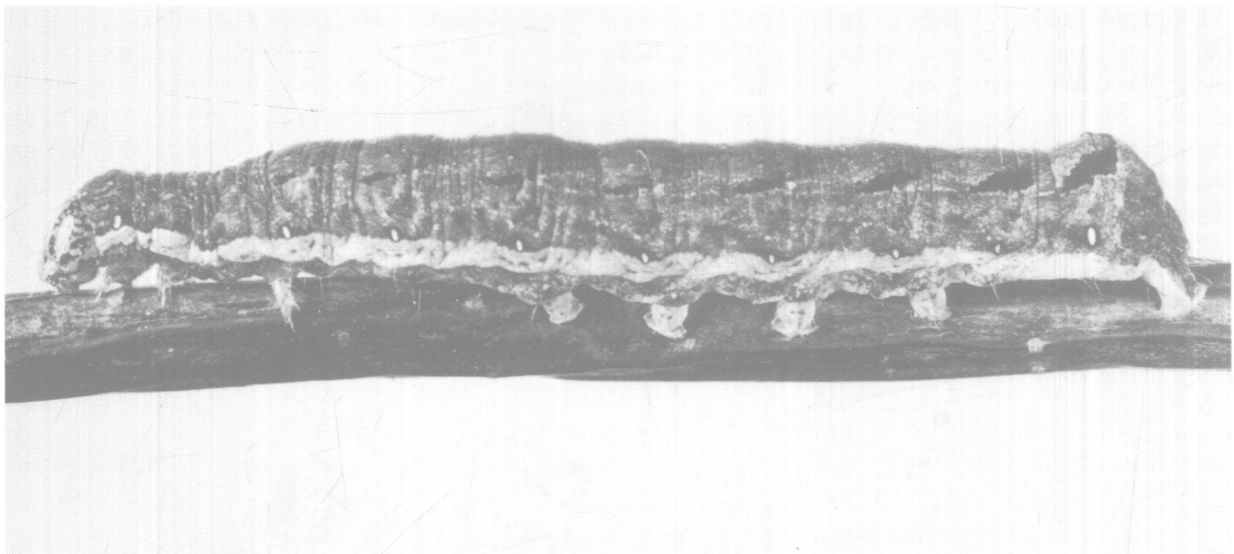

Figure 26.--Lateral view of spotted cutworm (3.5X).

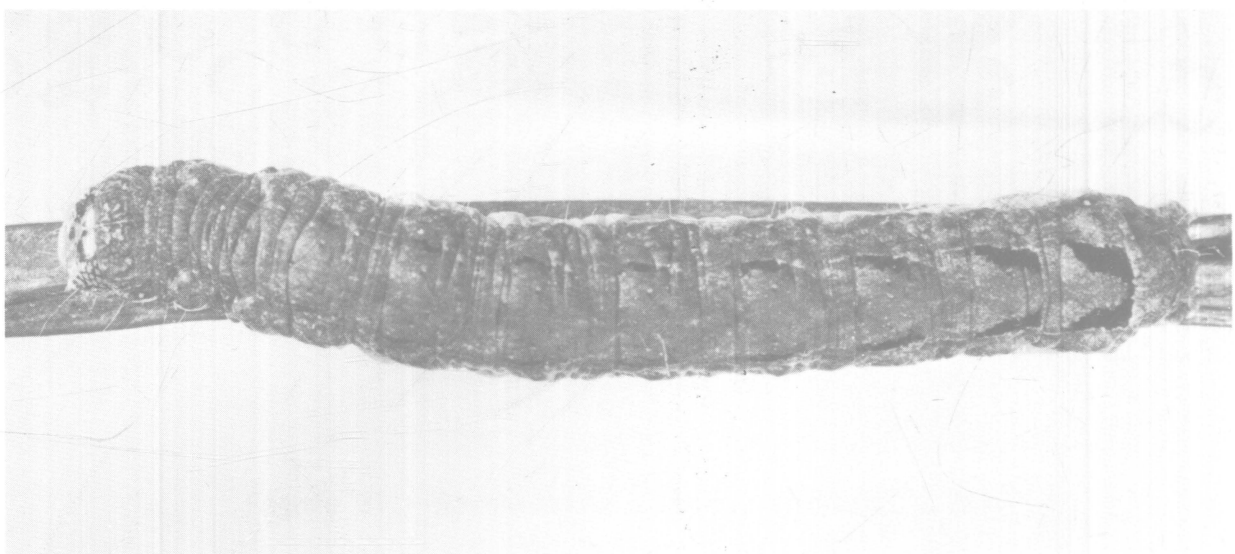

Figure 27.--Dorsal view of spotted cutworm (3.5X).

DINGY CUTWORM

Feltia ducens Walker

General color pale grayish-brown, sometimes tinged with reddish-brown. Body 32 mm. long and 5.5 mm. wide, tapering slightly posteriorly. Dorsum paler than supraspiracular area, often with a segmental series of indistinct ovoid or rhomboid figures. Supraspiracular area flecked with white ventrally, the dark coloration intensified subdorsally to form a black spot on at least the anterior half of each abdominal segment. Head pale brownish-gray with black submedial arcs and black or reddish-brown reticulation. Mandible with five distinct teeth on outer margin (Fig. 28). Skin bearing coarse, distinctly isolated, subconical granules (Fig. 29). Spiracles black. Setigerous tubercles large and black. This species cannot be distinguished from *Feltia herilis* (Grote) in the larval stage.

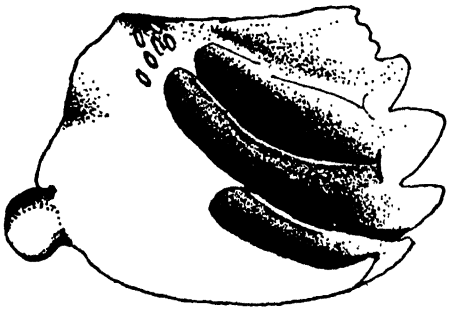

Figure 28.--Left mandible of the dingy cutworm (62X).

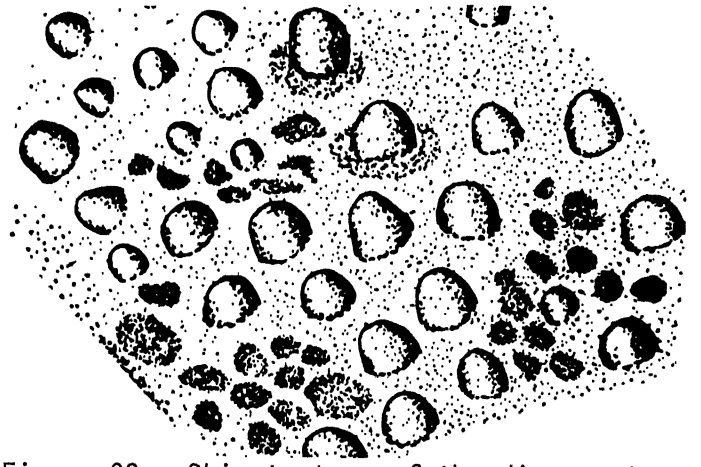

Figure 29.--Skin texture of the dingy cutworm (5,000X).

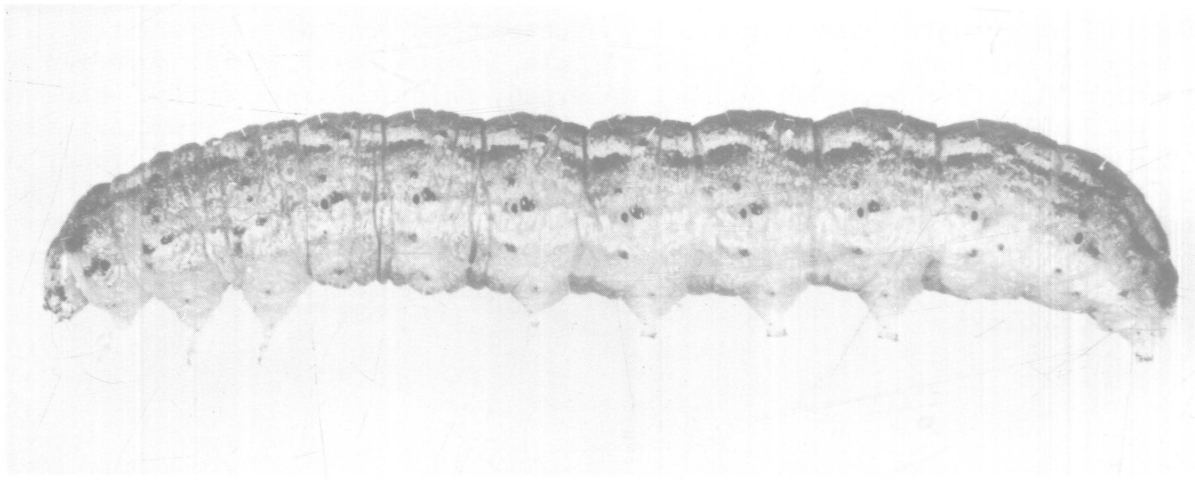

Figure 30.--Lateral view of dingy cutworm (4.7X).

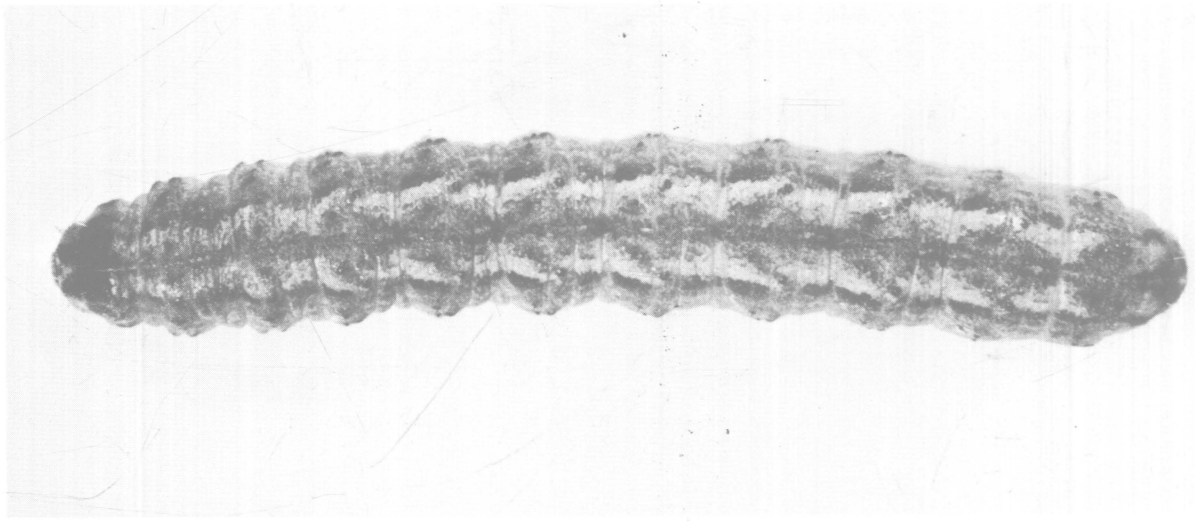

Figure 31.--Dorsal view of dingy cutworm (4.7X).

DARK-SIDED CUTWORM

Euxoa messoria (Harris)

General color pale brown dorsally; subventral and ventral areas whitish. Body about 30 to 35 mm. long and 5 mm. wide. A pale, narrow mesal stripe bordered by an irregular black stripe on each side. A broad, pale subdorsal stripe which includes two darkly pigmented tubercles on each of the thoracic and abdominal segments; below the subdorsal is a narrow, dark-brown stripe followed by another broad, pale stripe. Below this is the dark-brown supraspiracular stripe which gives the species its common name of "dark-sided" cutworm. The spiracular, subspiracular, subventral, and ventral areas are all whitish. Head pale brown with clusters of darker brown, round spots near the cervical shield, also above and behind the ocelli. Skin smooth. Spiracles dark brown.

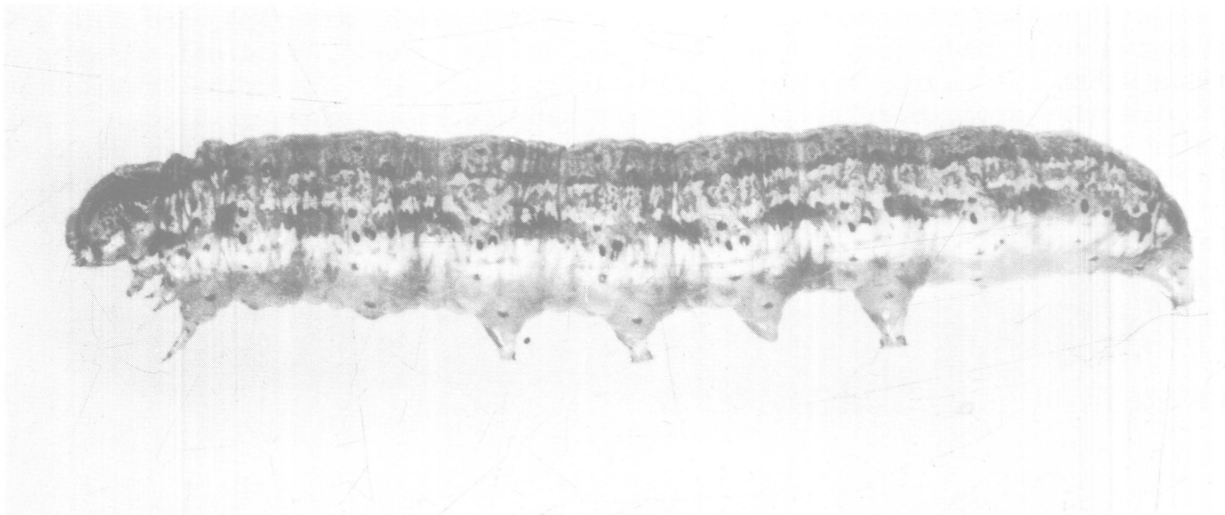

Figure 32.--Lateral view of dark-sided cutworm (5X).

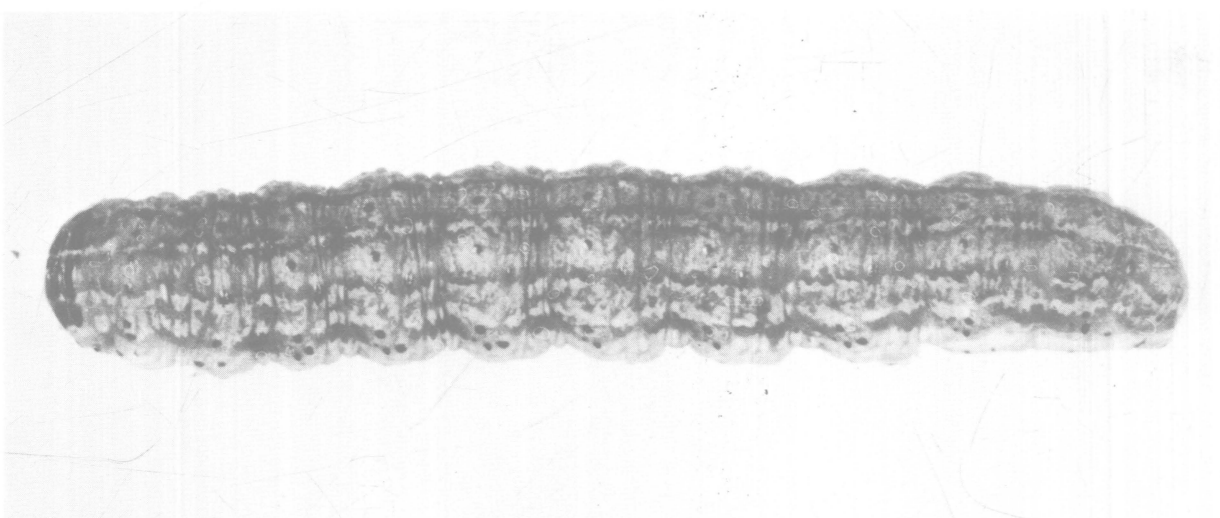

Figure 33.--Dorsal view of dark-sided cutworm (5X).

FALL ARMYWORM

Spodoptera frugiperda (J. E. Smith)

General color ranges from pinkish through yellowish, greenish, and dull gray to almost black. Body about 30 mm. long and 4.5 mm. wide. Abdominal segments about equal in width. A faint, narrow, pale mid-dorsal stripe. Dorsum paler than the supraspiracular area, overlaid with strands and flecks of brown or black. A narrow, yellowish line below subdorsal area. Supraspiracular area darker dorsally, particularly in a marginal black dash anteriorly on each abdominal segment. A broad, sharply defined, yellowish or whitish subspiracular stripe, mottled with reddish-brown.

Head grayish, yellowish, or brownish; adfrontal areas and adjacent margin white, submedial arcs and reticulation reddish-brown, darker dorsally (Fig. 34). Skin bearing very small, round, convex granules. Spiracles pale surrounded by white. Setigerous tubercles large, nearly flat, darkly pigmented.

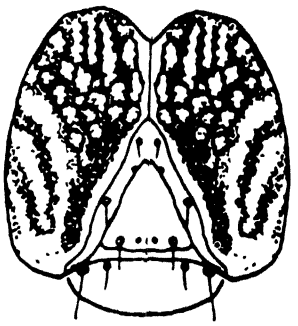

Figure 34.--Front view of head characters (13X).

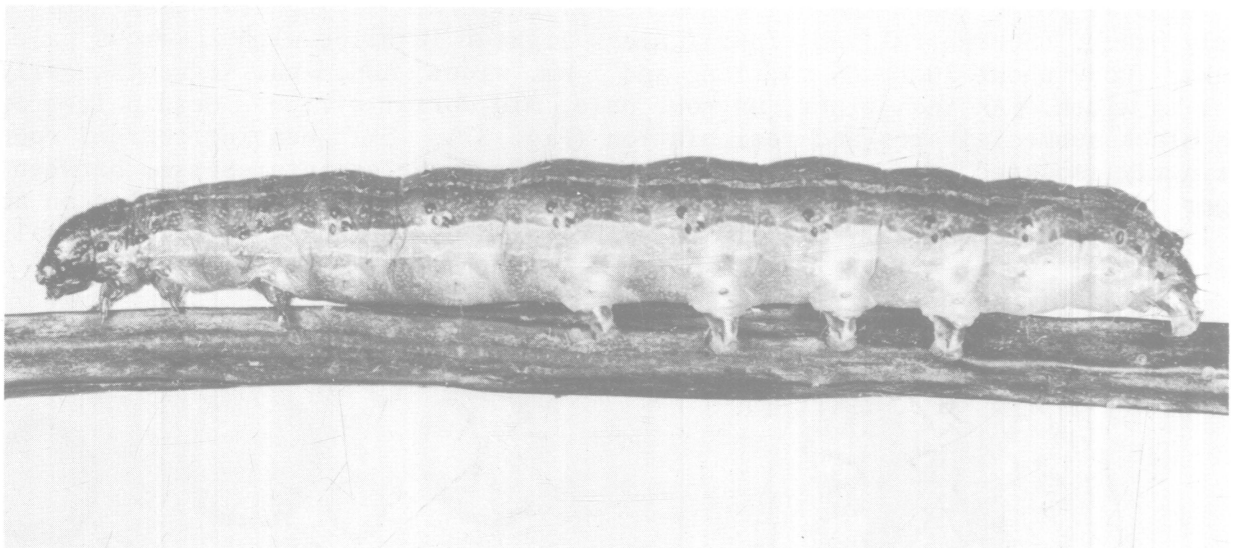

Figure 35.--Lateral view of fall armyworm (5X).

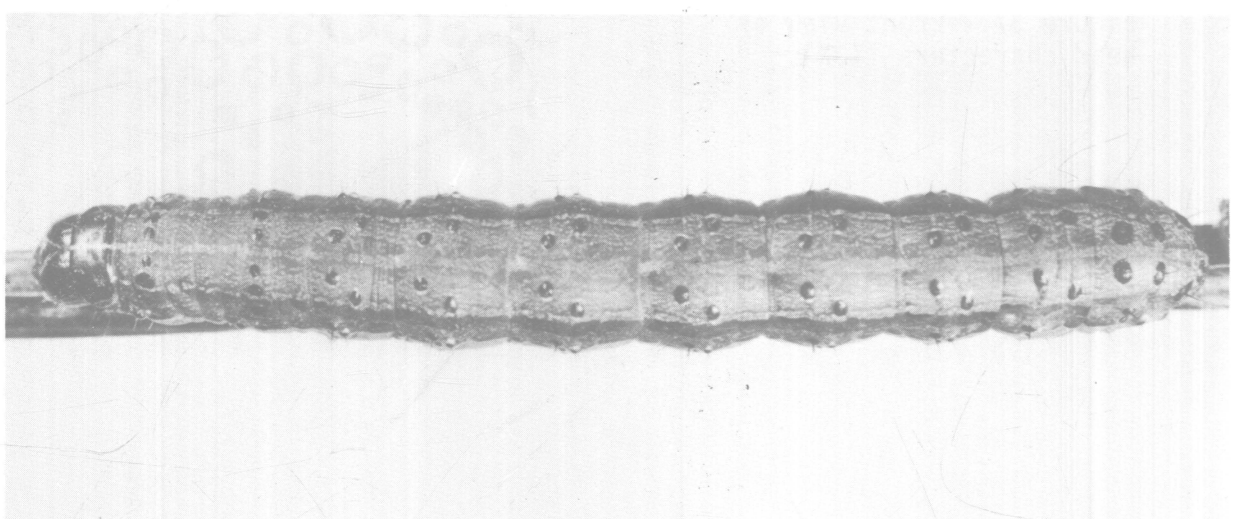

Figure 36.--Dorsal view of fall armyworm (5X).

BLACK CUTWORM

Agrotis ipsilon Hufnagel

General color above the spiracles nearly uniform, varying from light gray to nearly black. Subventral and ventral areas lighter in color with numerous pale flecks. Body about 30 to 45 mm. long and 7 mm. wide. Abdominal segments nearly equal in width. An indistinct, narrow, pale, mid-dorsal stripe. Head pale-brownish with black submedial arcs and reticulation (Fig. 37). Skin bearing convex, rounded, distinctly isolated, coarse granules with smaller granules interspersed between the larger granules (Figs. 38 and 41). Spiracles black. Setigerous tubercles on abdomen large; anterior dorsal tubercle only one-third as large as posterior dorsal tubercle.

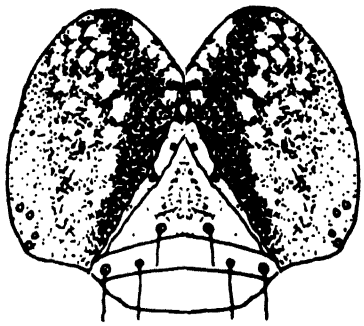

Figure 37.--Front view of head characters (13X).

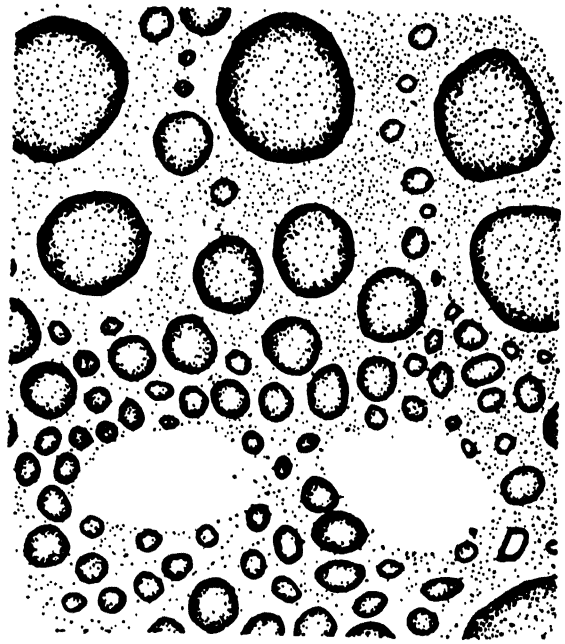

Figure 38.--Skin granulation (5,000X).

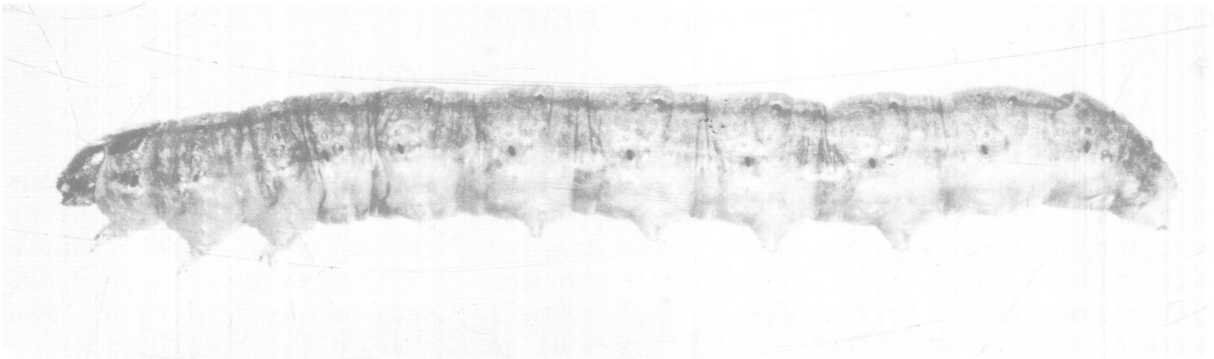

Figure 39.--Lateral view of black cutworm (3.7X).

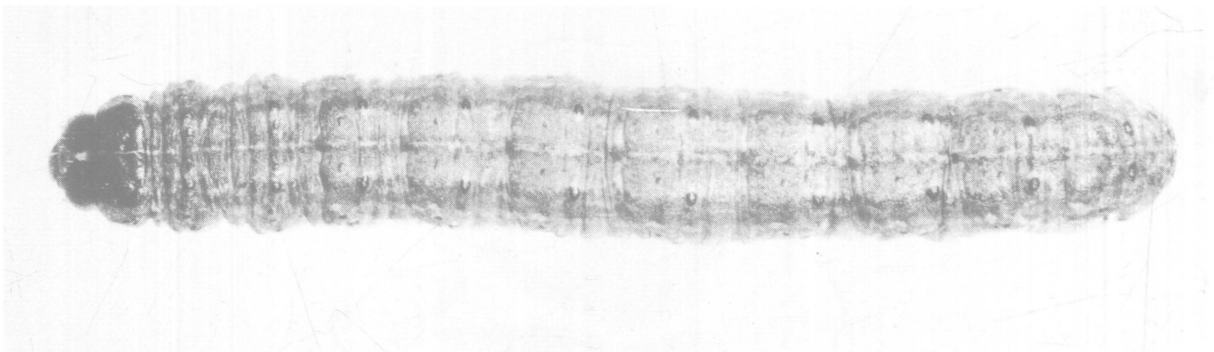

Figure 40.--Dorsal view of black cutworm (3.7X).

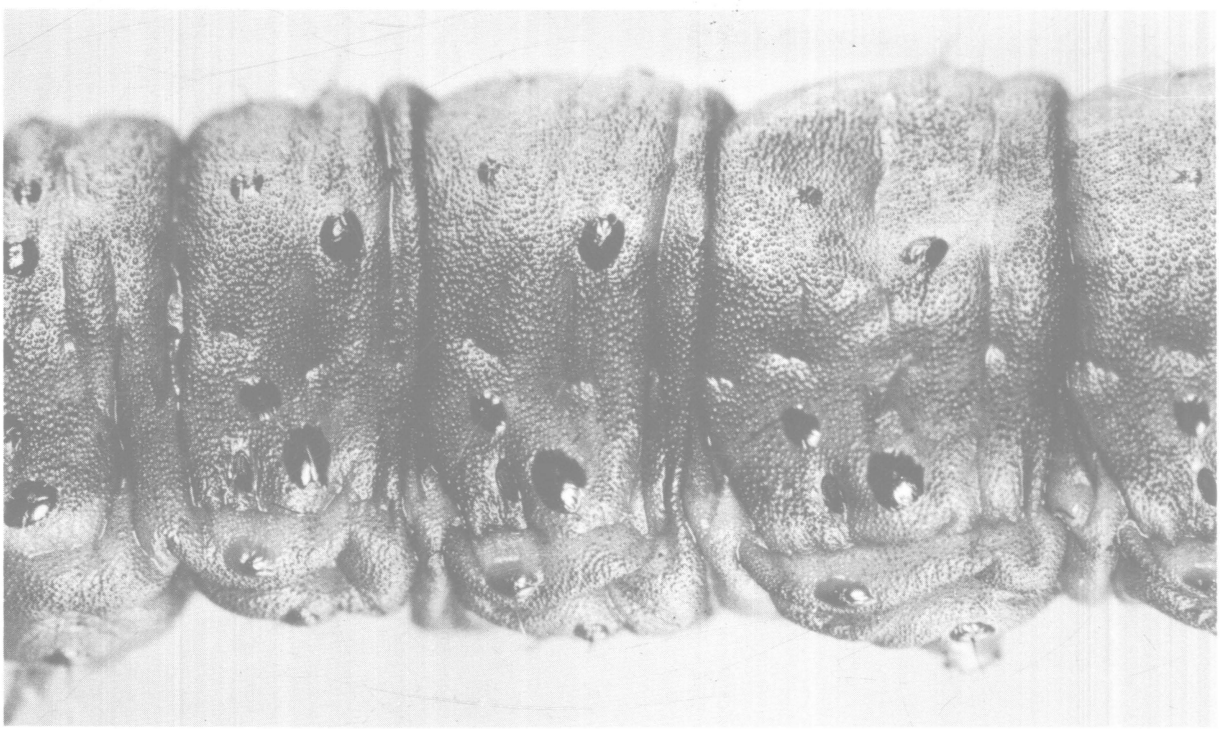

Figure 41--Enlarged portion of first three abdominal segments showing highly pigmented tubercles and skin granulation. Lateral view. (10X).

GLASSY CUTWORM

Crymodes devastator (Brace)

General color translucent, greenish-white with a faint, dark, subcutaneous mid-dorsal line. Body about 35 to 40 mm. long and 5.5 mm. wide. No conspicuous markings or longitudinal stripes. Setigerous tubercles rather large, black, bearing bristly, black setae. Skin indistinctly granulose. Spiracles brown. Head bright reddish-brown showing only traces of dark submedial arcs and reticulation. Mandible with four distinct, blunt teeth. Cervical shield heavily pigmented.

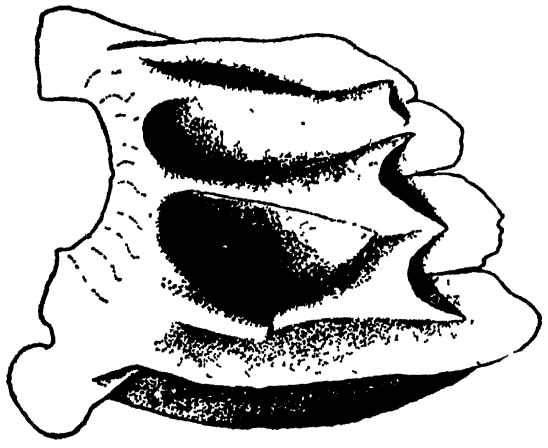

Figure 42.--Left mandible of glassy cutworm (62X).

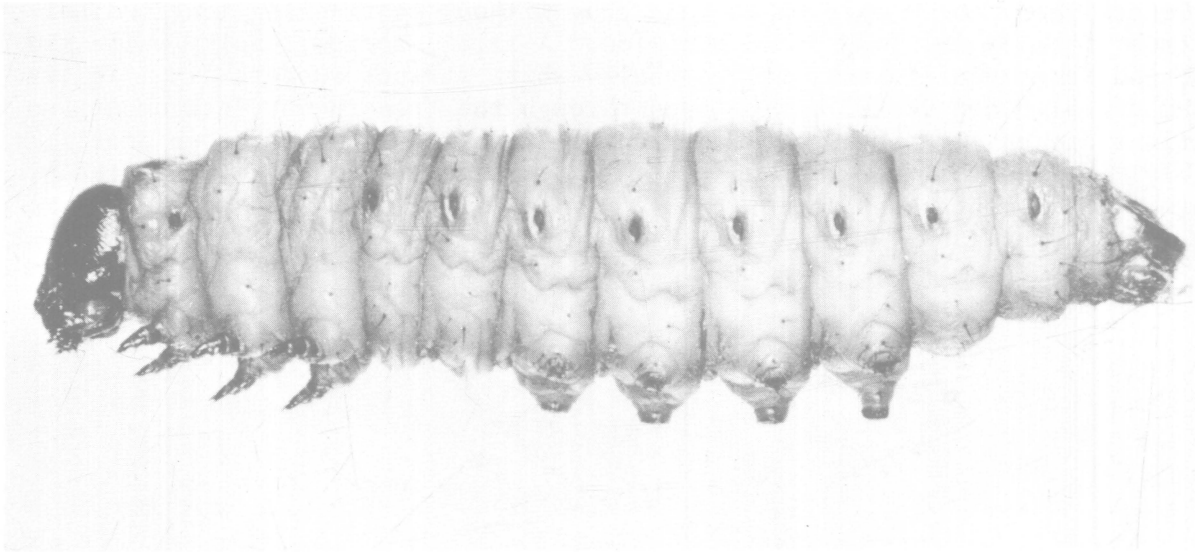

Figure 43.--Lateral view of glassy cutworm (3.7X).

Figure 44.--Dorsal view of glassy cutworm (3.7X).

SANDHILL CUTWORM

Euxoa detersa (Walker)

General body color whitish to pale gray without contrasting longitudinal stripes Body from 30 to 35 mm. long and 5 mm. wide. A faint, narrow, chalky-white mid-dorsal stripe and three equidistant, faint, chalky-white stripes subdorsally. In live larvae the dorsal blood vessel can be seen through the translucent integument and the pulsations are easily observed. Head tan with contrasting dark-brown ocelli; tip of mandibles dark brown. Cervical shield tan, not heavily pigmented as in the glassy cutworm. Skin smooth. Spiracles brown, rimmed with black. Setigerous tubercles small and inconspicuous.

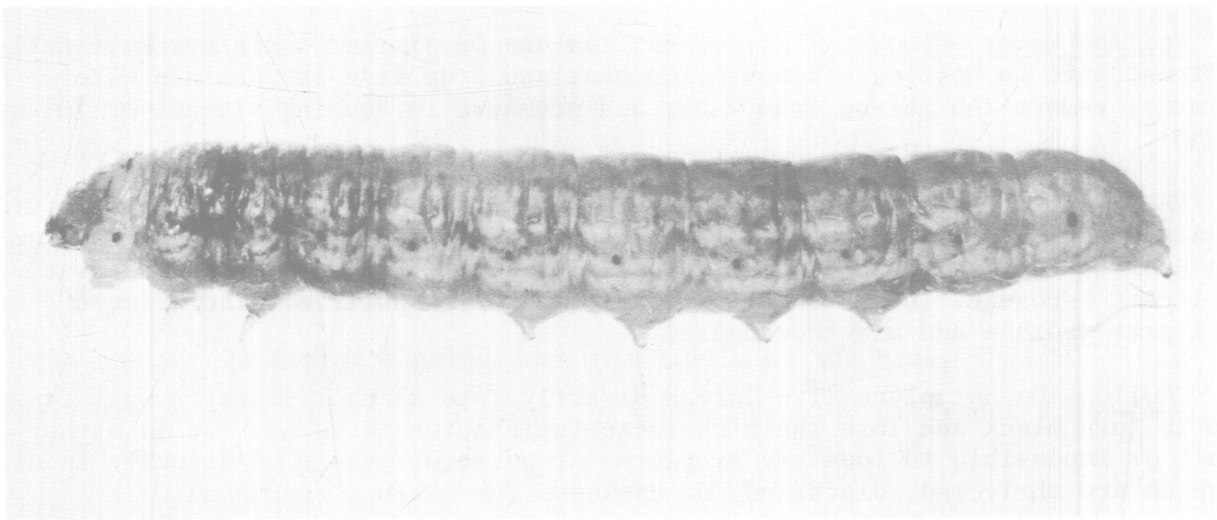

Figure 45.--Lateral view of sandhill cutworm (5X).

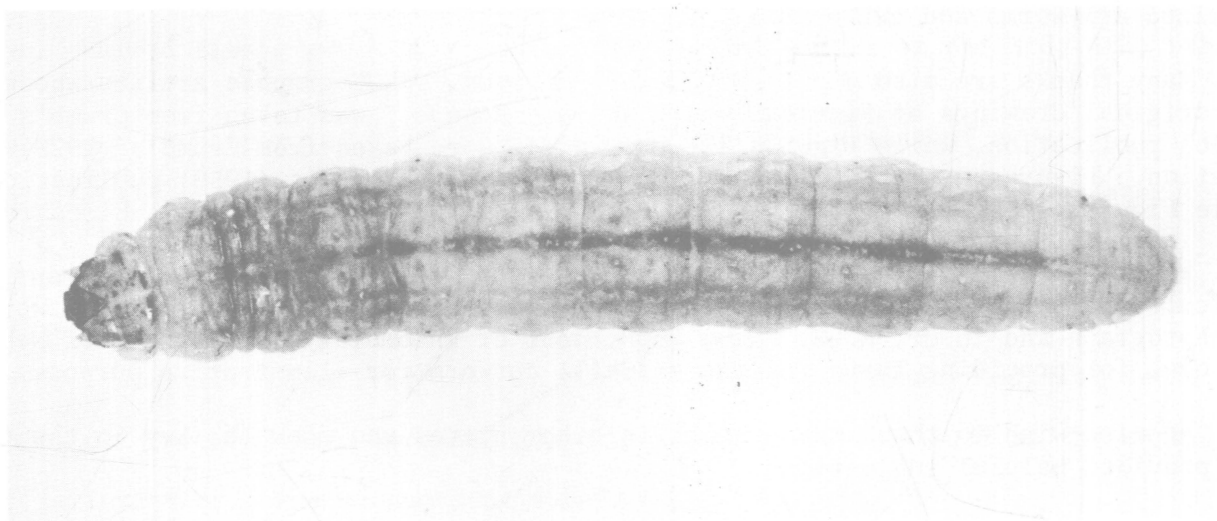

Figure 46.--Dorsal view of sandhill cutworm (5X).

How to Preserve Armyworms and Cutworms

To preserve larvae for future study or to send them away for identification, follow one of the following procedures:

Boiling water method: Fill a clean tin can or similar container half full of water and heat to boiling. Remove from heat and drop live larvae into water. After 1 minute, remove the larvae from water and preserve in rubbing alcohol or 70% ethyl alcohol.

KAAD method: Fill a screw-cap vial with KAAD and drop live larvae into vial. Replace cap, lay vial on side, and allow to set for 24 hours. Transfer the larvae from KAAD to rubbing alcohol or 70% ethyl alcohol. To prepare KAAD preservative, use 1 part kerosene, 10 parts of 95% ethyl alcohol, 2 parts of glacial acetic acid, and 1 part dioxane and mix thoroughly.

CAUTION--Do *not* place live larvae directly into alcohol since it will cause them to turn black and lose their characteristic color patterns. It is either difficult or impossible to identify armyworms or cutworms preserved directly in alcohol or which are shriveled, distorted, or darkened for various reseasons.

Acknowledgments

Sincere appreciation is expressed to Mr. Glenn Berkey, OARDC staff photographer, who provided the original photographs of the lateral and dorsal views of live, anesthetized armyworms and cutworms.

Many thanks are also due to Mr. Newell Hartrum, OARDC graphic artist, who made the original drawings of Figures 1 to 6 and 8. Figure 7 was taken from Crumb's (1956) publication, while Figures 25, 28, and 42 were taken from Crumb's (1929) publication. Figures 9, 18, 28, and 38 were taken from Walkden's (1950) publication, while Figures 12, 15, 21, 24, 34, and 37 were modified from this same publication.

We are grateful to Dr. C. R. Harris, Research Institute, Canada Department of Agriculture, London, Ontario, for providing live larvae of the dark-sided cutworm to photograph and to Dr. K. S. Pike, Department of Entomology, University of Nebraska, Lincoln, for providing larvae of the sandhill cutworm for illustrative purposes.

We also wish to thank cooperators in other states who used the key in the field and provided helpful suggestions.

Glossary

Adfrontal sutures: The lines separating the adfrontal areas from the frontal areas (see Fig. 8).

Anal shield: A dorsal, shield-like plate on top of the last abdominal segment.

Anterior: Forward or towards the head end.

Cervical shield: A heavily pigmented and sclerotized flat, oval plate just behind the top of the head.

Dorsal: Pertaining to top or back.

Dorsum: Top or back.

Equidistant: Of equal distance.

Flecked: Sprinkled with small patches of color.

Granules: Rough grains as opposed to a perfectly smooth surface.

Granulate: A surface roughened by the development of granules.

Instar: The caterpillar stages between molts or skin-casting.

Lateral: Pertaining to the side of the body.

Longitudinal stripes: Prominent narrow or broad stripes running lengthwise or from head to tail.

Mandibles: Paired biting jaws of insects.

Mesal: Pertaining to the center of the back.

Mid-dorsal stripe: A stripe running down the middle of the back.

Mottling: Marked with blotches, streaks, or spots of color different from the background.

Neck shield: See cervical shield.

Ocelli: Darkly pigmented, small, oval eye-spots on each side of the head.

Ovoid: Egg-shaped.

Posterior: Pertaining to the rear of the body.

Prolegs: Paired fleshy protruberances on the ventral aspect of the 3rd, 4th, 5th, 6th, and last abdominal segments.

Reticulation: A pattern of narrow lines resembling the threads of a net.

Rhomboidal: An area resembling a rectangle but with the corner angles greater or less than 90°.

Segmental series: A pattern or marking which is repeated on a series of thoracic or abdominal segments.

Setigerous tubercles: Small or conspicuous bumps bearing slender hairs or setae.

Sclerotized: Pertaining to hardened brown or black structures such as the mandibles.

Sheen: A luster or shine produced by a reflection of light.

Skin texture: The smooth or granulate appearance of the surface of the skin on the sides and back of the thoracic and abdominal segments.

Spiracle: An oval, breathing pore on the sides of thoracic and abdominal segments of caterpillars.

Spiracular stripe: A longitudinal stripe which includes the spiracles.

Subconical: Nearly cone-shaped.

Subcutaneous: Just beneath the skin.

Submedial arcs: Heavily pigmented, crescent-shaped markings on the head (see Fig. 8).

Subspiracular stripe: A longitudinal stripe just below the spiracles (see Fig. 7).

Subventral: Area between lateral and ventral area.

Supraspiracular stripe: A longitudinal stripe just above the spiracles.

Teeth: Sharp-pointed structures on cutting edge of the mandible.

Translucent: Partially transparent as frosted glass.

True legs: Sharp-pointed, tapering structures on ventral thoracic segments. Two per segment.

Tubercle: A small, rounded projection or bump.

Ventral: Pertaining to the underside or bottom.

References

Crumb, S. E. 1915. A key to the cutworms affecting tobacco. J. Econ. Entomol., 8(4):392-396.

Crumb, S. E. 1929. Tobacco cutworms. U.S. Dep. Agr., Tech. Bull. 88:1-180.

Crumb, S. E. 1956. The larvae of the Phalaenidae. U.S. Dep. Agr., Tech. Bull. 1135:1-356.

Johansen, Carl. 1973. How to recognize cutworms, armyworms, and loopers. Pacific Northwest Coop. Ext. Serv. Pub. No. 130:1-31.

Okumura, G. T. 1959. Illustrated key to the lepidopterous larvae attacking lawns in California. Calif. Dep. Agr., Bull. 48(1):15-21.

Peterson, Alvah. 1962. Larvae of insects. Lepidoptera and plant-infesting Hymenoptera. Edwards Bros. Inc., Ann Arbor, Mich. 315 pp.

Walkden, H. H. 1950. Cutworms, armyworms, and related species attacking cereal and forage crops in the Central Great Plains. U. S. Dep. Agr. Circ. 849:1-52.